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northwestern. The faults which separate the blocks of the system are believed to have been formed without control by the more ancient faults of the region. This conclusion has much in common with views which have been held concerning the movement of blocks of the earth's crust within the Great Basin of the western United States (Clarence King), and in Iceland as well (Thoroddsen).

The greater number of Central American volcanoes are cinder cones often with deep radial barrancos whose present shape and magnitude are believed to express the result of some decades of erosion. Upon the flanks of the larger cones there are, however, in many cases, parasitic cones, and these are seldom arranged in straight lines and apparently never along radial lines. Many of the larger volcanoes, in common with those of Mexico, show in place of true parasitic cones, a larger or smaller number of cones of much the same dimensions which do not rest upon the flanks of the principal mountain but are found in its vicinity. Being obviously in causal association with the larger mountains these smaller satellites are described as "companion volcanolets" (*Begleitvulkächen*). Whenever a strong wind was blowing during an eruption the parasitic cone which has resulted has attained a greater height upon the windward (western) side and the projectiles have been carried much farther to leeward.

Outflow of lava has played a large rôle in the formation of many volcanoes, and these composite cones upon being dissected by erosion present the lava flows as great ribs which stand in relief. If the main crater wall is found ruptured in more than one place, the breaks are generally two in number, opposite and in the direction of the longer axis of the cone.

Maare, the exceptionally low and broad craters, are especially numerous in Central America, but whether they are due to explosive eruptions or to infall, Sapper has been unable to determine.

As regards the materials exuded or ejected, these are found to be for the most part andesites and basalts, the latter generally a later product. Quartz, porphyry, diabase, porphyrite, and dacite become important in Nicaragua.

The great backbone of mountains and the blanketing masses of andesite, rhyolite and basalt in Central America are to be regarded as the products of gigantic fissure eruptions which took place in Tertiary and particularly in Oligocene times. The more modern eruptions in Central America began in the Quaternary and developed successive periods of culminating intensity. In Nicaragua particularly these have resulted in important changes in the coast line, in the stream net-work, and in the surface relief of the country; though the modern period of activity must be accounted as small in comparison with that of the Tertiary, and the historic eruptions as relatively few in number. The paper closes with a valuable chronological list of the volcanic and seismic phenomena which are on record for the Central American region, this list being expanded from that of de Montessus.

WILLIAM HERBERT HOBBS.

History of the Discovery and Conquest of Costa Rica. By Ricardo Fernández Guardia. Translated by Harry Weston Van Dyke. xxi and 416 pp. Maps, ills., index. T. Y. Crowell Co., New York, 1913. 8½ x 6.

The stories of Spanish conquest in the new world bring to light characters who met the ordeals of the strange land with fortitude. While now and then a leader turns out a rascal, the heroic and the just outnumber the degenerate, and histories of the various periods of expansion are inspiring. This is particularly true of this account of the early settlements in Costa Rica. The author has delineated the characters and lives of many brave conquistadores of the sixteenth, seventeenth and eighteenth centuries. The opening chapter gives a brief account of the geography of the land and prepares the reader for the strife of conquest by accounts of the five indigenous races which though never large in number were able to harass the Spaniard for three centuries. Then follows the story of a great array of Spanish leaders who in one way or another, inspired by high ideals or a lust for gain, penetrated this unpromising land to the south.

ROBERT M. BROWN.